DOCUMENT RESUME

ED 168 884 SE 027 513

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TITLE Probability of Success in College Chemistry.
PUB DATE 78
NOTE 10p.; Paper presented at the Meeting of the Tennessee Academy of Science (Lambeth College, Jackson, Tennessee, November 17, 1978)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Achievement Tests; *Chemistry; *College Science; Educational Research; *Grade Prediction; Grades (Scholastic); Higher Education; *Predictive Ability (Testing); Science Education; *Testing

ABSTRACT

The following 8 variables were tested as predictors of success of students enrolled in freshman chemistry at Tennessee Technological University: (1) ACT subtest in natural science; (2) ACT subtest in mathematics; (3) ACT composite scores; (4) final course grade in high school chemistry; (5) final course grade in high school physics; (6) high school grade point average; (7) final course grades in high school algebra II; and (8) final course grades in high school senior mathematics. Data were obtained on 138 students enrolled in Chemistry 111 (mostly engineering, chemistry and pre-professional majors). The single best predictor of success was the ACT composite score. Students with an ACT composite score below 22 had a high probability of failure. In addition, students who made less than a B in high school chemistry had a poor rate of success. (BB)

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PROBABILITY OF SUCCESS IN COLLEGE CHEMISTRY

by

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A Paper
Presented at the
Science and Mathematics Teachers Section
of the
Tennessee Academy of Science
at
Lambuth College
Jackson, Tennessee

17 November 1978

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INTRODUCTION

This investigation was conducted on the campus of Tennessee Technological University in the Fall Quarter, 1976. Data were obtained from the chemistry departmental records and from the students' permanent records. The variables reported in this paper include the following:

1. ACT subtest in natural science
2. ACT subtest in mathematics
3. ACT composite scores
4. Final course grade in high school chemistry
5. Final course grade in high school physics
6. High school quality point average
7. Final course grades in high school algebra II
8. Final course grades in high school senior mathematics
9. Final course grade in college chemistry 111

The first eight variables were utilized in determining the best set of predictors for chemistry 111. Statistical analyses employed in the study included multiple linear regression and crosstabulations.

POPULATION

The population for this study consisted of all the students enrolled in Chemistry 111 in the fall quarter of 1976. The Chemistry 111, 112, 113 sequence is composed mostly of engineers, chemistry majors, and pre-professional students. There were 702 students enrolled in this Chemistry 111 course. This particular quarter was chosen because it was recent and the population was large.

SAMPLE

A random sample of 150 students was selected from the total population of 702 students. Data were not available for 12 of the 150 students, thus reducing the sample size to 138 cases. Ten of these 12 cases were withdrawals and the remaining 2 cases were foreign students. (The dependent variable, final course grade in Chemistry 111, was the unattainable variable for the 10 withdrawal students and all of the continuous variables were lacking from the foreign students' permanent records.)

PRESENTATION OF FINDINGS

The results from the regression analysis indicated that the single best predictor of success in chemistry 111 was the composite score on the ACT. The simple Pearson product-moment correlation was .66 between the ACT composite and the grades in chemistry 111. The next variable which added to the explained predictability was the grade in high school physics. The resulting multiple R for both of the predictors was .68, only a small addition to the ACT composite score.

To facilitate the interpretation of the regression analysis, a crosstabulation of grades in chemistry 111 and ACT composite scores was computed. The initial step in the computation involved the categorization of the ACT composite scores into five groups. These groups and the results from the crosstabulations are depicted in Table I. The results indicate that students who enroll in chemistry 111 with ACT

TABLE I

RELATIONSHIP OF ACT COMPOSITE SCORE TO GRADE IN CHEMISTRY 111

ACT Composite	Grade in Chemistry 111 F	D	C	B	A	Total
16 and under	8(47.1%)	7(41.2%)	2(11.8%)	0(0.0%)	0(0.0%)	17(12.6%)
17-19	8(28.6%)	12(42.9%)	7(25.0%)	1(3.6%)	0(0.0%)	28(20.7%)
20-22	13(34.2%)	10(26.3%)	11(28.9%)	4(10.5%)	0(0.0%)	38(28.1%)
23-25	1(4.8%)	4(19.0%)	5(23.8%)	9(42.9%)	2(9.5%)	21(15.6%)
26-35	0(0.0%)	1(3.2%)	6(19.4%)	21(67.7%)	3(9.7%)	31(23.0%)
Total	30(22.7%)	34(25.2%)	31(23.0%)	35(25.9%)	5(3.7%)	135(100.0%)

TABLE II

RELATIONSHIP OF HIGH SCHOOL CHEMISTRY GRADE TO GRADE IN CHEMISTRY 111

High School Grade	Grade in Chemistry 111 F	D	C	B	A	Total
D	2(40.0%)	0(0.0%)	3(60.0%)	0(0.0%)	0(0.0%)	5(4.8%)
C	6(30.0%)	9(45.0%)	4(20.0%)	1(5.0%)	0(0.0%)	20(19.0%)
B	7(16.7%)	9(21.4%)	12(28.6%)	14(33.3%)	0(0.0%)	42(40.0%)
A	2(5.3%)	6(15.8%)	9(23.7%)	17(44.7%)	4(10.5%)	38(36.2%)
Total	17(16.2%)	24(22.9%)	28(26.7%)	32(30.5%)	4(3.8%)	105(100.0%)

composite scores below 22 have a high probability of failure or will likely achieve a D or F in the course. Students who have ACT composite scores less than the full admission status for Tennessee Technological University, an ACT composite of less than 17, have a very low probability of success in chemistry 111.

A crosstabulation of high school and college chemistry grades was computed and constitutes TABLE II. The results reveal that students who made less than a grade of B in high school chemistry have a poor success rate in chemistry 111.

There is an apparent discrepancy in this conclusion when one observes that 60 percent of those who received a grade of D in high school chemistry made a grade of C in college chemistry. However, the small sample is insufficient to generalize to the population at large.

Crosstabulations were computed for each of the remaining predictor variables and the grades in chemistry 111. Since the results are evident, no discussion will be made. These results depicted in TABLES III - VIII are in the Appendix of this paper.

TABLE IX

RELATIONSHIP OF HAVING COMPLETED CHEMISTRY, PHYSICS AND SENIOR MATHEMATICS ON SUCCESSFUL COMPLETION OF CHEMISTRY 111

Courses Completed	Grade in Chemistry 111 F	D	C	B	A	Total
None of the above	11(61.1%)	4(22.2%)	1(5.6%)	2(11.1%)	0(0.0%)	18(100%)
Chemistry only	8(22.9%)	7(20.0%)	12(34.3%)	8(22.9%)	0(0.0%)	35(100%)
Chemistry & Physics	3(15.0%)	10(50.0%)	4(20.0%)	3(15.0%)	0(0.0%)	20(100%)
Chemistry, Physics & Senior Math	3(9.7%)	4(12.9%)	6(19.4%)	15(48.4%)	3(9.7%)	31(100%)
Physics & Senior Math	0(0.0%)	3(37.5%)	3(37.5%)	1(12.5%)	1(12.5%)	8(100%)
Chemistry, Physics, Senior Math and High School QPA of 3.00 or above	0(0.0%)	2(10.5%)	4(21.1%)	3(15.8%)	3(15.8%)	19(100%)

The results shown in Table IX indicate that both the quality and quantity of high school background enters into the prediction of success in college chemistry. There is also direct evidence that very few students enter college with adequate background. Only 31 students or 23 percent of the students have completed all three high school courses-chemistry, physics, and senior mathematics. The success rate for these students was considerably better than for other students. When the restriction of a 3.0 quality point average for high school plus completion of chemistry, physics, and senior mathematics is applied the results indicate that only 19 students or 14.1 percent of the sample met these qualifications. Their success rate was much better with no failing grades in chemistry 111 and only 10.5 percent with a grade of D.

CONCLUSIONS AND RECOMMENDATIONS

The results from the study lead to the following conclusions and recommendations:

1. There is a very high failure rate for students enrolled in chemistry 111.
2. Very few students entering chemistry 111 have the type of background which best predicts success in the course. There is a definite need to encourage more high school students to complete courses in chemistry, physics and senior mathematics.
3. Consideration should be given to improving the advising system at Tennessee Technological University so fewer students will be doomed to failure. There may be a need for courses designed to prepare students who failed to acquire appropriate high school background.
4. Replication of this study in an expanded format may be needed. Attention should be given to the effects of college coursework on success in the course.

APPENDIX

TABLE III

RELATIONSHIP OF ACT SCIENCE SCORE TO GRADE IN CHEMISTRY 111

ACT Science	Grade in Chemistry 111 F	D	C	B	A	Total
16 and under	5(38.5%)	6(46.2%)	2(15.4%)	0(0.0%)	0(0.0%)	13(9.6%)
17-19	8(53.3%)	5(33.3%)	1(6.7%)	1(6.7%)	0(0.0%)	15(11.1%)
20-22	1(5.9%)	6(35.5%)	6(35.5%)	4(23.5%)	0(0.0%)	17(12.6%)
23-25	9(33.3%)	8(29.6%)	9(33.3%)	1(3.7%)	0(0.0%)	27(20.0%)
26-up	7(11.1%)	9(14.3%)	13(20.6%)	29(46.0%)	5(7.9%)	63(46.7%)
Total	30(22.2%)	34(25.2%)	31(23.0%)	35(25.9%)	5(3.7%)	135(100%)

TABLE IV

RELATIONSHIP OF ACT MATHEMATICS SCORE TO GRADE IN CHEMISTRY 111

ACT Math	Grade in Chemistry 111 F	D	C	B	A	Total
16 and under	11(55.0%)	4(20.0%)	5(25,9%)	0(0.0%)	0(0.0%)	20(14.8%)
17-19	3(13.6%)	13(59.1%)	5(22.7%)	1(4.5%)	0(0.0%)	22(16.3%)
20-22	6(30.0%)	6(30.0%)	5(25.0%)	3(15.0%)	0(0.0%)	20(14.9%)
23-25	6(20.0%)	9(30.0%)	8(26.7%)	6(20.0%)	1(3.3%)	30(22.2%)
26-up	4(9.3%)	2(4.7%)	8(18.6%)	25(58.1%)	4(9.3%)	43(31.9%)
Total	30(22.2%)	34(25.2%)	31(23.0%)	35(25.9%)	5(3.7%)	135(100.0%)

TABLE V

RELATIONSHIP OF HIGH SCHOOL PHYSICS TO GRADE IN CHEMISTRY 111

High School Physics	Grade in Chemistry 111 F	D	C	B	A	Total
D	0(0.0%)	1(50.0%)	1(50.0%)	0(0.0%)	0(0.0%)	2(3.1%)
C	5(41.7%)	4(33.3%)	2(16.7%)	1(8.3%)	0(0.0%)	12(18.8%)
B	1(4.0%)	9(36.0%)	5(20.0%)	9(36.0%)	1(4.0%)	25(39.1%)
A	1(4.0%)	6(24.0%)	6(24.0%)	9(36.0%)	3(12.0%)	25(39.1%)
Total	7(10.9%)	20(31.3%)	14(21.9%)	19(29.7%)	4(6.3%)	64(100.0%)

TABLE VI

RELATIONSHIP OF HIGH SCHOOL QPA TO GRADE IN CHEMISTRY 111

High School QPA	Grade in Chemistry 111 F	D	C	B	A	Total
LT 2.25	13(61.9%)	5(23.8%)	1(4.8%)	2(9.5%)	0(0.0%)	21(17.5%)
2.25-2.49	7(38.9%)	7(38.9%)	3(16.7%)	1(5.6%)	0(0.0%)	18(15.0%)
2.50-2.99	4(16.7%)	11(45.8%)	4(16.7%)	5(20.8%)	0(0.0%)	24(20.0%)
3.00-3.49	2(6.9%)	7(24.1%)	12(41.4%)	6(20.7%)	2(6.9%)	29(24.2%)
3.50-4.00	0(0.0%)	3(10.7%)	8(28.6%)	14(50.0%)	3(10.7%)	28(23.3%)
Total	26(21.7%)	33(27.5%)	28(23.3%)	28(23.3%)	5(4.2%)	120(100.0%)

TABLE VII

RELATIONSHIP OF GRADE IN HIGH SCHOOL ALGEBRA II TO GRADE IN CHEMISTRY 111

Grade HS Algebra II	Grade in Chemistry 111 F	D	C	B	A	Total
D	6(60.0%)	4(40.0%)	0(0.0%)	0(0.0%)	0(0.0%)	10(8.2%)
C	6(24.0%)	10(40.0%)	5(20.0%)	3(12.0%)	1(4.0%)	25(20.5%)
B	9(14.8%)	16(26.2%)	20(32.8%)	16(26.2%)	0(0.0%)	61(50.0%)
A	1(3.8%)	3(11.5%)	4(15.4%)	14(53.8%)	4(15.4%)	26(21.3%)
Total	22(18.0%)	33(27.0%)	29(23.8%)	33(27.0%)	5(4.1%)	122(100.0%)

TABLE VIII

RELATIONSHIP OF GRADE IN HISH SCHOOL SENIOR MATHEMATICS TO GRADE IN CHEMISTRY 111

Grade HS Senior Mathematics	Grade in Chemistry 111 F	D	C	B	A	Total
D	1(50.0%)	0(0.0%)	1(50.0%)	0(0.0%)	0(0.0%)	2(3.3%)
C	4(25.0%)	4(25.0%)	3(18.8%)	4(25.0%)	1(6.3%)	16(26.7%)
B	2(11.8%)	3(17.6%)	5(29.4%)	7(41.2%)	0(0.0%)	17(28.3%)
A	0(0.0%)	4(16.0%)	6(24.0%)	11(44.0%)	4(16.0%)	25(41.7%)
Total	7(11.7%)	11(18.3%)	15(25.0%)	22(36.7%)	5(8.3%)	60(100.0%)